

Confirmation No. 6084

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appellant:	SURDEANU <i>et al.</i>	Examiner:	Lin, J.
Serial No.:	10/550,741	Group Art Unit:	2815
Filed:	September 22, 2005	Docket No.:	NL030347 US1 (NXPS.279PA)
Title:	GATE ELECTRODE FOR SEMICONDUCTOR DEVICES		

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**REPLY BRIEF**

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Customer No. <b>65913</b>
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Dear Sir:

This is a Reply Brief submitted pursuant to 37 C.F.R. § 41.41(a)(1) for the above-referenced patent application. This Reply Brief is submitted in response to the Examiner's Answer dated September 17, 2010.

Authorization is given to charge/credit **Deposit Account 50-4019 (NL030347US1)** all required fees/overages to enter this paper.

**I. Status of Claims**

Claims 6-14 and 17-24 stand rejected and are presented for appeal. Claims 1-5 and 15-16 are cancelled.

**II. Grounds of Rejection**

The grounds of rejection to be reviewed on appeal are as follows:

- A. Claims 6-7, 10-14, 17 and 20-24 stand rejected under 35 U.S.C. § 103(a) over Rhee (U.S. Patent No. 6,667,525) in view of Suguro (U.S. Patent Pub. 2001/0039107) and further in view of Tao (U.S. Patent No. 6,399,515).
- B. Claims 8 and 18-19 stand rejected under 35 U.S.C. § 103(a) over the ‘525, ‘107 and ‘515 references in view of Holloway (U.S. Patent No. 6,222,251).
- C. Claim 9 stands rejected under 35 U.S.C. § 103(a) over the ‘525, ‘107 and ‘515 references in view of Gardner (U.S. Patent No. 6,160,300).

**III. Appellant’s Reply Argument**

The following argument supplements, rather than replaces, the arguments presented in the underlying Appeal Brief.

As repeatedly asserted throughout Appellant’s Appeal Brief, the Examiner’s rejections consistently fail to consider the asserted references as a whole, contrary to M.P.E.P. § 2142.02. By ignoring the specific teachings of the asserted references, the Examiner fails to recognize the impropriety of the asserted combinations and the lack of motivation to combine provided by the references. In the discussion below, Appellant cites to specific portions of the various asserted references to call attention to the lack of proper motivation to combine the references, and in some instances the lack of correspondence.

Appellant notes that the Examiner’s Answer contains new grounds for rejection including an assertion, for the first time, that the primary reference may inherently teach the claimed grain size. *See* page 12 of Examiner’s Answer. This assertion along with others will be discussed in more detail below.

**A. The Rejection Of Claims 6-7, 10-14, 17 And 20-24 Is Improper.**

**1. The Examiner Fails To Provide A Proper Reason For The Proposed Combination.**

Contrary to the requirements of M.P.E.P. § 2143.01, the Examiner has not provided a valid reason to combine the asserted references. The only reason provided for combining the references is based on teachings of grain size, that, upon a careful review of the secondary '107 reference, are only applicable to metal gate electrodes. In addition, the asserted benefit of the secondary '107 reference regarding variation in threshold voltage arises from a problem taught as unique to the use of metal gate electrodes. Despite both references acknowledging the presence of variations in threshold voltage, the mechanism responsible for these variations differ, and no evidence has been provided to support an assertion that the solution taught in the secondary '107 reference could be used in the primary '525 reference as suggested by the Examiner. As explained below, the effect of grain size on metal gate electrodes is not shown to solve the threshold voltage variation problems associated with silicon-based electrodes. Accordingly the § 103(a) rejection is improper.

As repeatedly brought to the attention of the Examiner, the asserted reason for combining the references lacks support because of differences in poly-silicon layers and metal layers in a gate electrode. One of skill in the art would not take teachings relating to reducing the variation in work function of a metal electrode and apply those to a problem arising from the diffusion of Ge between layers.

A careful reading of the references as a whole, as required by M.P.E.P. § 2142.02, shows that both the primary '525 reference and the secondary '107 reference acknowledge that variations in threshold voltage can occur when at least one silicon gate layer is used. *See, e.g.*, Col. 2:5-13 of the '525 reference and paragraphs 0025 and 0027 of the '107 reference. In addition, both the references acknowledge that the variation in threshold voltage occurs because of impurity diffusion from a silicon layer into the gate oxide layer. *See id.* The references, however, differ in how this problem is treated, the reasons the threshold variation occurs, and the motivation for the additional modifications. In the primary '525 reference one of the gates made of poly-Si is replaced with poly-SiGe. In the secondary reference the poly material is removed and replaced with metal electrodes. Both

of these alternatives give rise to different issues affecting variation in threshold voltage. In the '525 reference the replacement of the lower layer with poly-SiGe gives rise to a new problem regarding diffusion of Ge from the lower layer to the upper layer. In instances where diffusion occurs, the addition of Ge loses its effectiveness. *See* Col. 3:6-18. The primary '525 reference teaches using different grain sizes to prevent diffusion of Ge. In the '107 reference the replacement of polysilicon layers with metal layers results in the threshold voltage varying because "a metallic crystal has work function that differ with crystal orientations....[and] the threshold voltage of a MOS transistor is affected by the work function of the gate electrode." Paragraph 0067 of the '107 reference. The secondary '107 reference goes on to disclose using specific grain sizes to reduce the variation in work function. Accordingly, although the grain size is mentioned in connection with variation in threshold voltage for both the primary '525 reference and the '107 reference, the purposes of the specified grain sizes are very different. In the primary '525 reference, the grain size is used to prevent diffusion in Ge, and in the secondary '107 reference the grain size is used to reduce variation in work function resulting from the metal crystal orientation.

Accordingly, the record contains no explanation or suggestion for why one of ordinary skill in the art would view the teachings of the '107 reference regarding to grain size in a metal electrode as somehow applicable to the grain size of a polysilicon electrode in the '525 reference. Because the only reasoning in support of the legal conclusion of obviousness is premised upon this improper and rebutted motivation, the rejection lacks sufficient evidentiary support. Accordingly, the Examiner's § 103(a) rejection fails to meet the requirements of §§ 2141 and 2143.01, and is contrary to relevant case law, including *KSR*. The rejections are therefore improper.

## **2. The Examiner's Newly Presented Attempts at Asserting Correspondence Are Improper And Without Support.**

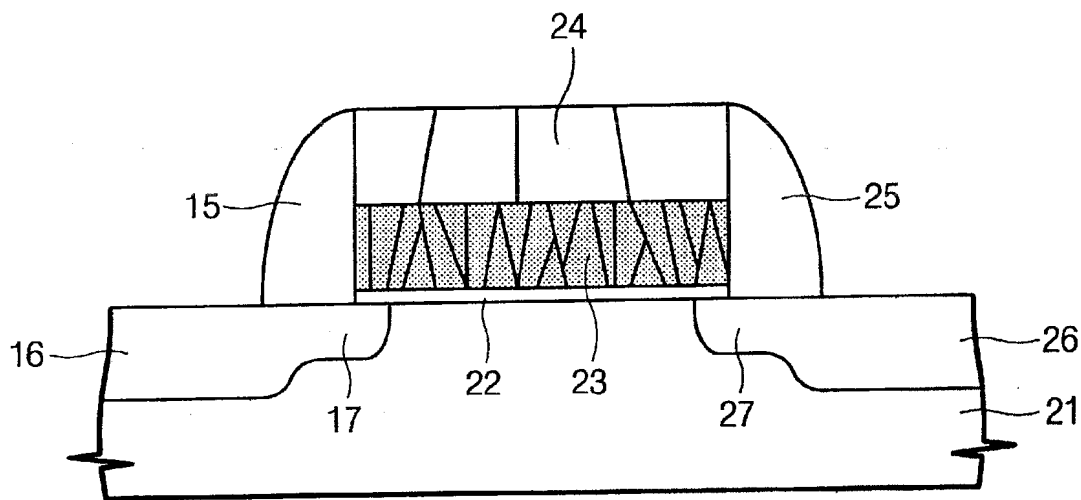
In an implicit acknowledgement of the deficiencies of the asserted rejections, the Examiner has, for the first time, attempted to assert that the primary '525 reference teaches aspects of the claimed invention, regarding the grain size of the upper gate layer being at least twice as large at the grain size of the lower gate layer, through the depiction in Fig. 3.

The Examiner has failed to properly acknowledge this new grounds for rejection.

Notwithstanding, Appellant submits that the Examiner's inference is improper, and without foundation.

The Examiner appears to be asserting that the grain sizes shown in Fig. 3 show, to the naked eye, that the grains in the upper gate layer are at least twice as large as the grains in the lower gate layer. However, regardless of whether the grains appear to be twice the size, the inference that they are in fact twice the size cannot be made. This is because Fig. 3 is not drawn to scale. The '525 reference discloses the lower layer as being 600-700 Angstroms thick, while the upper layer is 1300-1400 Angstroms thick. In Fig. 3, as reproduced below, the upper layer 24 does not appear to be approximately twice as thick as lower layer 23. Because Fig. 3 is not to scale, inferences regarding the actual size of the grains with respect to each other cannot be made, and the explicit disclosure of the '525 reference must be relied on.

Accordingly, any assertions of correspondence to claim limitations regarding relative grain size based on Fig. 3 of the '525 reference are improper.



For at least these reasons, the § 103(a) rejection are improper and Appellant therefore requests the rejection be reversed.

**B. The Rejection Of Claims 8 And 18-19 Is Improper.**

The Examiner again presents new grounds of rejection without acknowledgment, in responding to Appellant's Appeal Brief.<sup>1</sup> Notwithstanding, Appellant renews the previously presented arguments regarding the improper assertion of a results effective variable.

The Examiner asserts that because the primary '525 reference and the secondary '107 reference disclose problems with dopant penetration, that accordingly, the doping profile across a gate electrode is a result effective parameter. However, as discussed previously, the dopant penetration problems of the '525 reference and the '107 reference are not related either to the dopant penetration problems of the tertiary '251 reference, or the problems disclosed within Appellant's specification. The Examiner's current rejection amounts to an assertion that if a particular parameter (in this case dopant penetration) has been shown to effect one result, one would be motivated to modify it even if the goal of the modification is to reach a different result. The Examiner's contentions are particularly troubling in the instant case because the newly relied-on discussion of dopant penetration does not discuss dopant profiles within an active material, but rather the migration of the dopant from a layer to the substrate, outside of the active material.

Appellant further asserts that the combination of references used to reject claims 8 and 18-19 are improper for the reasons discussed above in Section A1.

For at least these reasons the § 103(a) rejection is improper and Applicant request it be overturned.

**C. The § 103(a) Rejection Of Claim 9 Is Improper.**

Appellant incorporates herein by reference the arguments regarding claim 9 as were presented in the Appeal Brief.

The Examiner's Answer fails to address aspects of Appellant's arguments that the primary '525 reference teaches away from the Examiner's asserted modifications.

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<sup>1</sup> New grounds of rejection should be acknowledged when changes are made to the *precise reason* for the rejection and not upon the statutory basis alone. *See, e.g., Hyatt v. Dudas*, 551 F.3d 1307, 1312 (Fed. Cir. 2008) ("a 'ground of rejection' for purposes of Rule 1.192(c)(7) is not merely the statutory requirement for patentability that a claim fails to meet but also the precise reason why the claim fails that requirement.") Accordingly, it is not proper to materially-change the precise reason for the rejection without acknowledging that such a change represents new grounds of rejection.

Specifically, the Examiner continues to assert that one of skill in the art would modify the primary '525 reference to result in a hypothetical embodiment in which the '525 reference discloses as an intermediate step on the path to the preferred embodiment and a method of solving the problem of Ge diffusion. The Examiner's contentions amount to an assertion that the use of amorphous material is "good enough" even though the '525 reference discloses a solution it believes to be better. One of skill in the art would not be motivated to modify the '525 reference to perform an inferior job at solving the asserted problem. Accordingly, the '525 reference teaches away from the proposed modification and one of skill in the art would not modify the '525 reference as claimed.

Appellant asserts that the § 103(a) rejection of claim 9 is further improper for the reasons discussed above in section A1.

Accordingly, the § 103(a) rejection of claim 9 is improper and Appellant requests that it be reversed.

#### **IV. Conclusion**

In view of the above, and the underlying Appeal Brief, Appellant submits that the rejections of claims 6-14 and 17-24 are improper and therefore requests reversal of the rejections as applied to the appealed claims and allowance of the entire application.

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